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FELT MOLDED PRODUCT AND ITS MANUFACTURING METHOD

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FELT MOLDED PRODUCT AND ITS MANUFACTURING METHOD

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Claims /1*

1. A felt molded product, characterized by the fact that in felt molded product (1) formed of a fiber cotton (4) and a resin binder (5), a hard surface layer (2) and a soft elastic core layer (3) are continuously formed in a body.

2. The felt molded product of Claim 1, characterized by the fact that the felt molded product (1) is formed of 60-90 wt% fiber cotton (4) and 40-10 wt% resin binder (5); said molded product has an apparent density of 0.06-0.3 g/cm^3, a thickness of 3-50 cm, and a compressive elastic modulus of 50% or more; the hard surface layer (2) is at least 0.5 mm thick; said hard surface layer (2) forms a high-density layer with a good surface strength in which the fiber cotton (4) is strongly fixed with the resin binder (5); the apparent density of said surface layer is 0.08-0.4 g/cm^3; the soft elastic core layer (3) continuously integrated with said surface layer (2) is a low-density layer with an elasticity in which the fiber cotton (4) is loosely fixed with the resin binder (5), represents at least 1/2 or more of the total thickness of the molded product, and has an apparent density as low as 0.05-0.25 g/cm^3; and the apparent density ratio of the above-mentioned hard surface layer (2) and the above-mentioned soft elastic core layer (3) is 1.1-2.0.

3. A method for manufacturing a felt molded product, characterized by the fact that 40-10 wt% of resin binder (5) comprises 60-90 wt% fiber cotton (4) bulk, opened, and laminated, so that a fiber mat (6) is formed; and the fiber mat is heated and pressurized in a range of the melting point of the resin binder (5) to a temperature higher than the melting point by 110EC and under temperature, pressure, and time conditions in which the compression rate is 60-96% and

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* [Numbers in the right margin indicate pagination of the original text.]

the compression recovery rate during the decompression is 50-5% in the shape change of the fiber mat (6) during molding, immediately decompressed, and solidified by cooling down to a temperature lower than the melting point of the resin binder (5) in a shape state in which the compression recovery rate of the fiber mat (6) is 50-5%.

Detailed explanation of the invention

Industrial application field

The present invention pertains to a felt molded product with good surface strength and cushion characteristic, which is formed of a fiber cotton and a resin binder, wherein the uppermost surface part is a smooth surface with few raised fibers, the surface part is a high-density layer with a high surface strength where the fiber cotton is strongly fixed with the/2 resin binder, and the inside integrated with the surface part is a low-density layer with an elasticity where the fiber cotton is loosely fixed with the resin binder, and its manufacturing method. The felt molded product has good usage durability and cushion characteristic due to the above-mentioned characteristics and is optimum as a cushion material for beds, cushions, carpets, tatami mats, packing, and other usages.

Prior art

The felt molded product of the present invention belongs to a conventional thick unwoven fabric category. As conventional unwoven fabrics, there are wet unwoven fabrics using a resin binder, needle-punched unwoven fabrics, water flow-entangled unwoven fabrics, melt-blown unwoven fabrics, etc., in addition to the above-mentioned unwoven fabric. Their manufacturing methods are each different, and each product is unique. However, in these conventional unwoven fabric manufacturing methods, the strong resin fixing of only the surface part, the needle punching, or the water-flow entangling are difficult, and even if these treatments are possible, fixing of the surface part by only these treatments is insufficient. Thus, unlike the present invention, an unwoven fabric with an integrated structure in which the uppermost surface is a smooth surface with few raised fibers, the surface part is a high-density layer with a good surface strength, and the inside is a low-density layer with elasticity cannot be formed.

Therefore, in the case where the conventional thick unwoven fabric is used as a cushion material for beds, a fabric or a thin unwoven fabric with a reliable structure is adhered to the surface of the relatively soft, elastic, thin unwoven fabric, so that the surface strength is reinforced.

Problems to be solved by the invention

However, in these conventional methods, since there is no integration between the surface reinforcing material and thick unwoven fabric, the usage durability is inferior, and the cushion characteristic is not good. Furthermore, the cost is raised, and the [manufacturing] productivity is poor. The present invention provides a felt molded product with a totally new structure, in which these problems are all solved, and a manufacturing method.

Means to solve the problems

The present invention is a felt molded product (1) formed of a fiber cotton (4) and a resin binder (5). The felt molded product is characterized by the fact that a hard surface layer (2) and a soft elastic core layer (3) are continuously formed in a body.

Furthermore, the felt molded product (1) is formed of 60-90 wt% fiber cotton and 40-10 wt% resin binder, and the molded product has an apparent density of 0.06-0.3 g/cm^3, a thickness of 3-50 cm, and a compressive elastic modulus of 50% or more. The hard surface layer (2) is at least 0.5 mm thick. The hard surface layer (2) forms a high-density layer with a good surface strength in which the fiber cotton is strongly fixed with the resin binder, and its apparent density is 0.08-0.4 g/cm^3. The soft elastic core layer (3) continuously integrated with the surface layer (2) is a low-density layer with an elasticity in which the fiber cotton is loosely fixed with the resin binder, represents at least 1/2 or more of the total thickness of the molded product, and has an apparent density as low as 0.05-0.25 g/cm^3. At the same time, the apparent density ratio of the above-mentioned hard surface layer (2) and the above-mentioned soft elastic core layer (3) is 1.1-2.0.

The appropriate manufacturing method of the felt molded product of the present

invention is as follows. In other words, 40-10 wt% of resin binder comprises 60-90 wt% fiber cotton bulk, opened, and laminated, so that a fiber mat (6) is formed. Then, the fiber mat is heated and pressurized in a range of the melting point of the resin binder to a temperature higher than the melting point by 110EC and under temperature, pressure, and time conditions in which the compression rate is 97-50% and the compression recovery rate during the decompression is 5-60% in the shape change of the fiber mat (6) during molding, immediately decompressed, and solidified by cooling down to a temperature lower than the melting point of the resin binder in a shape state in which the compression recovery rate of the fiber mat (6) is 5-60%.

In explaining the present invention in further detail, methods for measuring the property values are mentioned. In the felt molded product and its partial thickness measurement, a dial gauge type thickness measurer (a pressure load of 50 g/cm^2) based on JIS-L-1096 was used, and in the measurement of the initial fiber mat thickness and the compression interval for calculating the compression rate during molding, a steel rule, vernier calipers, or a clearance gauge was used. Also, samples for measuring the apparent density of the surface part and the inside of the felt molded product were prepared by disassembling each sectional part of the product by [illegible]. Also, in the definition of terms, the compression rate = (fiber mat thickness - compression interval)/fiber mat thickness x 100, and the compression recovery rate = felt molded product /3 thickness/fiber mat thickness x 100. Furthermore, the compressive elastic modulus and the bursting strength of the felt molded product were measured according to JIS-L-1096, and the tensile strength and the tear strength were measured according to JIS-L-1085.

Referring to the figures, the present invention is explained below in further detail. The felt molded product (1) with good surface strength and cushion characteristic of the present invention is formed of 60-90 wt% fiber cotton (4) and 40-10 wt% resin binder (5). If the amount

of fiber cotton (4) is less than 60 wt%, that is, if the amount of resin binder is more than 40 wt%, the felt molded product is hardened, so that the cushion characteristic deteriorates. Also, if the amount of fiber cotton is more than 90 wt%, that is, if the amount of resin binder is less than 10 wt%, the internal strength as well as the surface strength of the surface part is lowered, so that the practicality disappears. Also, part or all of the resin binder can be replaced with a heat-fusible fiber cotton. Next, the total thickness of the felt molded product (1) of the present invention is 3-50 mm. If the thickness is less than 3 mm, the product is too thin, so that an apparent density difference between the surface part and the inside is difficult to create and the cushion characteristic is also not good. Also, if the thickness is more than 50 mm, the product is too thick, so that it is difficult to transfer heat to the central part during molding, fixing of the fiber cotton by the resin binder (5) is poor, and the strength is inferior. Also, the total apparent density is 0.06-0.3 g/cm^3. If the density is smaller than 0.06 g/cm^3, the total strength, the surface strength, and the cushion characteristics are insufficient, and if the density is greater than 0.3 g/cm^3, the product is too hard, so that the cushion characteristic is deteriorated.

Next, the most significant characteristic of the present invention is that the uppermost surface is a smooth surface with little raised fibers in which the fiber cotton is strongly fixed with the half-coated resin binder, and the surface part of at least within 0.5 mm of the thickness forms a high-density layer in which the fiber cotton is strongly fixed with the resin binder. The half-coated smooth surface and the high-density layer create an excellent surface strength, and the high-density layer of the surface part has a thickness of 0.5 mm or more and reaches 1-2 mm in many cases. The apparent density of the hard surface layer (2) is 0.08-0.4 g/cm^3. If the apparent density is smaller than 0.08 g/cm^3, the surface is too soft, so that the surface strength is poor, and if the apparent density is greater than the 0.4 g/cm^3, the surface is too hard, so that the

cushion characteristic is lowered.

Furthermore, a second characteristic of the present invention is that the soft elastic core layer (3) integrated with the hard surface layer (2) is a low-density layer with an elasticity in which the fiber cotton is loosely fixed with the resin binder and in particular, the central part, which represents at least 1/2 or more of the total thickness, has an apparent density of 0.05-0.25 g/cm^3 which is considerably lower than that of the surface part. If the apparent density is smaller than 0.05 g/cm^3, fixing of the internal fiber structure is insufficient, and the structure is easily collapsed and is too soft, so that the cushion characteristic is lowered. Also, if the apparent density is greater than 0.25 g/cm^3, the soft elastic core layer (3) is too hard, so that the cushion characteristic is lowered.

Furthermore, a third characteristic of the present invention is the density balance of the hard surface layer (2) and the soft elastic core layer (3), especially the latter and the central part, and the apparent density ratio is appropriately 1.1-2.0. If the apparent density ratio is less than 1.1, the density difference between two layers is too small, so that the entire layer is too hard, thereby deteriorating the cushion characteristic, or the entire layer is too soft, so that the surface strength is insufficient, thereby lowering the usage durability. Also, if the apparent density ratio is greater than 2.0, the density difference of two layers is too large, so that the hard surface layer (2) is too hard, thereby lowering the cushion characteristic, or the soft elastic core layer (3) is too soft, so that the shape is easily collapsed. As mentioned above, the felt molded product (1) in an optimum apparent density range has a compressive elastic modulus of 50% or more and has an optimum cushion characteristic as a cushion material. Also, as the constitution of the entire layer, the low-density soft elastic core layer (3) is right under the high-density hard surface layer (2), and its boundary is distinct in many cases. However, the density is slowly lowered between the

high-density hard surface layer (2) and the low-density soft elastic core layer (3), so that the boundary is sometimes not distinct.

As the fiber cotton (4) being used in the present invention, synthetic fibers such as polyester fiber, nylon fiber, acryl fiber, polyolefin fiber, and vinylon fiber, chemical fibers such as rayon fiber and acetate fiber, and natural fibers such as cotton, wool, silk, and hemp may be used alone or in combination. Also, the fiber cotton (4) being used in the present invention may be recovered waste cottons, in which waste cottons, waste threads, waste fabrics, or used cloths being generated in spinning process, unwoven fabric manufacturing process, fiber dyeing process, sewing process, etc., are opened, in addition to regular raw materials. The cotton is opened by a fiber opener, further opened by lapper, webber, etc., and laminated, so that the fiber mat (6) is formed. /4

As the resin of the resin binder (5) being used in the present invention, ordinary thermosetting resins or thermoplastic resins can be used. As the thermosetting resin, for example, there is a phenol resin, and as the thermoplastic resin, for example, there are polyethylene resin, polypropylene resin, polyester resin, nylon resin, polyurethane resin, polyvinyl chloride resin, epoxy resin, polystyrene resin, SBR, NBR, etc. As the form of the resin binder being used, powders, small particles with a diameter of 3-10 mm, fibers, nets, liquids dissolved or dispersed in a solvent can be used. The methods of use are classified in accordance with the shape of the resin binder (5). For example, a powder is sprayed on the fiber cotton (4) during an optional process from the opening to the fiber mat manufacture, a liquid is sprayed, spread, or immersed, or the resin is mixed into the fiber mat (6). Also, in case several fiber cottons with different melting points are used, the fiber cotton with a lower melting point can be used as the resin binder or part of it. The key in the selection of the resin binder (5) is to select the resin with a

melting point lower than the melting point of the fiber cotton (4) used as the main body.

Also, part of the purpose of the present invention is to provide a felt molded product with a density of the surface part higher than that of the interior, and for this purpose, it is also effective to raise the resin binder density of the surface part of the fiber mat being used in advance, compared with the interior. As an example of the method, there is a method that forms a fiber mat with the same resin binder density of the surface part and the interior and puts a resin binder powder or liquid on the surface of the fiber mat. Furthermore, colorants, antioxidants, moisture absorbents, deodorants, weighting agents, etc., can also be added in advance to the fiber mat.

Next, appropriate heating and pressuring molding conditions in the present invention are mentioned. Molding is carried out by a press. The press may be a discontinuous flat board type press or a continuous roll press or a belt press. After the press process using these presses, a metal plate or a steel belt or a roll press facility for cooling which smooths the surface and cools and solidifies the shape at a desirable compression recovery rate (desirable thickness) is required. In the molding performed under heating and pressurization, the heating and pressurization conditions are selected so that the resin binder can be melted, the fiber cotton is difficult to melt, and the temperature and pressure effect being exerted on the uppermost surface part of the fiber mat is stronger than that on the central part. For this reason, a system that slowly transfers heat from the fiber mat surface to the inside by a heat conduction from a hot press and a system that slowly transfers heat from the fiber mat surface to the inside by heating the press or the fiber mat surface by a radiant heat from an infrared heater or a far-infrared heater are effective. Also, a system that almost uniformly heats the surface and the inside by convection such as hot-air heating is not preferable. However, a combined system that preheats the fiber mat by hot air, etc.,

and finally heats it by the above-mentioned hot press is effective. Specifically, 60-90 wt% fiber cotton bulk and 40-10 wt% resin binder are molded by heating and pressurizing using the above-mentioned press in a range of the melting point of the resin binder to a temperature higher than the melting point and under the temperature, pressure, and time conditions in which the compression rate is 60-96% and the compression recovery rate during the decompression is 50-5% in the shape change of the fiber mat (6) during molding and then immediately decompressed, and the shape in which the compression recovery rate of the fiber mat is maintained at 50-5%.by the above-mentioned press faility for cooling. The fiber mat is solidified by cooling down to a temperature lower than the melting point of the resin binder while pressurizing or rubbing the surface. If the molding temperature is lower than the melting point of the resin binder, a reliably fixed molded product cannot be formed, and if the molding temperature is higher than the melting point by 110EC, the fiber mat is scorched, so that an offensive odor is emitted. Also, if the compression rate is greater than 96% and the compression recovery rate is smaller than 5%, the entire product is too hard, so that the cushion characteristic deteriorates. If the compression rate is smaller than 60% and the compression recovery rate is greater than 50%, the product is too soft, so that the surface strength is insufficient, thereby lowering the usage durability. Also, the factors that meet the above-mentioned optimum conditions are the fiber mat thickness, the apparent density, the molding temperature, the compression rate (molding temperature, pressure, thickness setup, time, etc., are related), and the compression recovery rate after molding (molding compression rate, thickness setup of the press facility during cooling, etc., are related), and the conditions of these factors appear as a result in the qualities of the molded product. The optimum conditions other than the molding pressure and time are the same as the above-mentioned conditions. As the pressure and time conditions,

pressure and time being the above-mentioned optimum compression rate and optimum compression recovery rate are selected in consideration of the temperature influence. Furthermore, as a favorable method for obtaining the optimum compression rate and compression recovery rate, there is a method that installs a thickness setter and a spacer for maintaining a prescribed interval between the upper and lower press boards, rolls, or belts during molding by heating and pressurizing and during fixing by cooling. With the use of these apparatuses, the optimum compression rate and compression recovery rate can be obtained, even if the molding temperature, pressure, time conditions are slightly shifted from the optimum conditions. Also, the thickness may be different in the interval set value being adopted when molding by heating and the interval set value being adopted when fixing by cooling.

As the molding treatment by heating and pressurizing, in addition to the above-mentioned one-stage molding method, a so-called two-stage molding method like this molding can also be applied. In this case, the first-stage compression rate (that is, thickness) is limited to the second-stage compression recovery rate or higher, etc., and at the second stage, the above-mentioned optimum compression rate and compression recovery rate conditions at the thickness prior to the first-stage molding are adopted. As the advantages of the two-stage molding method, since a fiber mat with a relatively stable shape is obtained at the first stage, handling at the second-stage molding is easy, and molded products with shapes other than a tabular shape are also easily formed.

Operation and effect of the invention

The felt molded product (1) of the present invention can be formed only by the raw materials, the raw material compositions, and the heating and pressurizing molding conditions of the present invention. In other words, the resin binder (5) is processed with the fiber cotton (4), and the fiber mat (6) formed by opening and laminating is molded under the heating and pressurizing conditions in which the resin binder (5) is melted, the fiber cotton (4) does not melt easily, and the temperature and pressure effect being exerted on the uppermost surface part of the fiber mat is stronger than the temperature and pressure effect being exerted on the central part are selected. Then, the fiber mat is subjected to pressing or rubbing and cooling fixing treatments for obtaining a dense smooth surface, so that the uppermost surface part is a smooth surface with few raised fibers where the fiber cotton (4) is strongly fixed with the resin binder (5), the surface part is a high-density layer with a high surface strength where the fiber cotton is strongly fixed with the resin binder, and its inside is a low-density layer, where the fiber cotton (4) is loosely fixed with the resin binder (5), having an elasticity and a density lower than the apparent density of the hard surface layer (2). Thereby, a felt molded product with good usage durability and cushion characteristic and having a new composition and structure, unlike conventional products, can be obtained.

Application examples

Next, embodiments of the present invention are explained by detailed examples, however the present invention is not limited to these application examples.

Application Example 1

Fabric wastes mixed with a polyester cotton generated in a sewing process was applied to a fiber opener, so that a waste cotton was manufactured. A polyethylene resin powder with a melting point of 135EC was almost uniformly mixed at a weight ratio of 4/1 of fiber/resin into the waste cotton obtained and applied to a simple card, so that a fiber mat (6) was prepared. The fiber mat (6) had a thickness of 60 mm and an apparent density of 0.28 g/cm^3 and was in a fluffy state.

Next, the above-mentioned fiber mat (6) was subjected to a tabular heating and pressurizing molding by the following method. First, the fiber mat (6) was placed between two sheets of chromium-plated iron tabular molds. Also, at four corners between these two sheets of tabular molds, the thickness of the fiber mat (6) was constantly maintained during molding, and an iron small plate segment with a thickness of 13 mm was placed as a spacer to give a difference in the heating and pressurizing effect to the uppermost surface part and the interior. With the installation of the spacer, the appropriate temperature and pressure range during molding is widened. Furthermore, the uppermost surface part of the fiber mat (6) is easily influenced by the heating and pressurizing effect, and the interior, especially the central part is not significantly influenced by the heating and pressurizing effect, which is appropriate. Next, the above-mentioned iron tabular molds in which the fiber mat (6) was sandwiched were mounted on a surface table of a hydraulic tabular hot press preheated to 210EC and pressed at a pressure of 30 kg/cm^2 for 60 sec (a compression rate of 78%), and the iron plate molds in which the fiber mat and the spacer were sandwiched were immediately transferred to another water-cooling press, cold-pressed at a pressure of 5 kg/cm^2 for 120 sec, and extracted.

The tabular felt molded product (1) obtained had a total thickness of 15 mm (a

compression recovery rate of 25%) and an apparent density of 0.11 g/cm^3. Its uppermost surface was a smooth surface with little raised fibers in which the fiber cotton was strongly fixed with a half-coated resin fiber, and a high-density layer with a good surface strength in which the fiber cotton was strongly fixed with the resin binder was formed on the surface part with a /6 thickness of about 1 mm. The apparent density was 0.15 g/cm^3, and an elastic low-density layer in which the fiber cotton (4) was loosely fixed with the resin binder (5) was formed at the inside. In particular, the apparent density of the central part (8 mm in thickness) was 0.08 g/cm^3.

The felt molded product (1), as shown in Table 1, has excellent property values, compared with conventional products. Also, the surface strength was measured by a cellophane tape peeling-off test according to a special method. The testing method was shown in the note of Table 1.

The felt molded product (1) has good usage durability and cushion characteristic due to the above-mentioned properties and is optimum as a cushion material for beds and cushions.

Comparative Example 1

The same fiber mat as that of Application Example 1 was sandwiched between a pair of upper and lower networked conveyor belts made of iron wire and passed for 240 sec through a hot-air treatment chamber preheated to 190EC. A thickness setter was set so that the gap between the upper and lower conveyor belts would be 13 mm when passing through the chamber, and the fiber mat was heated and pressurized by a method that pressed the conveyor belts by a number of pairs of non-hot press rolls. At that time, the compression rate was 78%. After passing through the chamber, the fiber mat was cooled by an air-cooling method and extracted from the conveyor belts, so that a felt molded product with a thickness of 18 mm (a compression recovery rate of 30%) and an apparent density of 0.094 g/cm^3 was obtained. In the felt molded product, since the hot air almost uniformly passed through the inside as well as the fiber mat surface during molding and since the fiber mat was pressed into a network shape instead of a surface shape, no difference in the apparent density could be formed between the surface part and the inside, so that the cushion characteristic was inferior. Also, the fiber fixing of the uppermost surface and the surface part by the resin binder was insufficient, a number of fibers were scattered on the uppermost surface, and the surface strength of the uppermost surface and the surface part was also poor. The property values of the felt molded product are shown in Table 1.

In using the felt molded product as a cushion material for beds, since the surface strength was insufficient, a cloth or a thin unwoven fabric with a reliable structure was adhered to the surface, so that the surface strength was reinforced.

Comparative Example 2

The same fiber mat as that of Application Example 1 was molded by heating using the same hot press and two sheets of chromium-plated iron tabular molds as those of Application Example 1. However, no spacer was used. In other words, the iron tabular molds in which the fiber mat was sandwiched were mounted on a surface table of a hydraulic tabular hot press preheated to 210EC and hot-pressed at a pressure of 50 kg/cm^2 for 60 sec (a compression rate of 96.7%). Next, the iron plate molds in which the fiber mat was sandwiched were immediately transferred to another water-cooling press, cold-pressed at a pressure of 5 kg/cm^2 for 120 sec, and extracted.*

The tabular felt molded product obtained had a total thickness of 2.5 mm (a compression recovery rate of 4.2%) and an apparent density of 0.68 g/cm^3, had no density difference between the surface part and the interior, had a plywood shape, was hard, and was not suitable for a cushion material.

Application Example 2

The felt molded product (a thickness of 18 mm and an apparent density of 0.94 g/cm^2) manufactured by Comparative Example 1 was treated under the same heating and pressurizing molding conditions (a temperature of 210EC, a pressure of 30 kg/cm^2, and a duration of 40 sec) as those of Application Example 1 and the same cold-pressing conditions (a pressure of 5 kg/cm^2 and a time of 120 sec) as those of Application Example 1 using the same hot press, two sheets of chromium-plated iron tubular molds, and iron plate small-piece spacer with a thickness of 13 mm as those of Application Example 1. The felt molded product obtained in this manner had a thickness of 14 mm and a total apparent density of 0.12 g/cm^3, and the surface layer (1 mm in thickness) with a dense uppermost surface having few raised fibers had an apparent density as high as 0.17 g/cm^3. Its inner elastic low-density layer had an apparent density as low as 0.09 g/cm^3 at the central part (8 mm in thickness), and appearance, sectional structure, and property values nearly equivalent to those of Application Example 1 were demonstrated. The property values are shown in Table 1.

The product has good usage durability and cushion characteristic due to the above-mentioned properties equivalent to those of Application Example 1 and is optimum as a cushion material for beds, cushions, and others.

Table 1 /7

Key:		
	1	Sample
	2	Application Example 1
	3	Application Example 2
	4	Comparative Example 1
	5	Item
	6	Thickness
	7	Apparent density
	8	Tensile strength
	9	Tear strength
	10	Compressive elastic modulus
	11	Bursting strength
	12	Surface strength * (Cellophane tape peeling-off test)
	13	No peeling-off
	14	Severe peeling-off

* Measuring method: After reinforcing the adhesion by rubbing a cellophane tape (25 x 120 mm) in the longitudinal direction of a specimen (50 x 150 mm) from the top by a beam rod with a length of 100 m, the end of 20 mm was held by hand and peeled off one at a time at 90E, and the surface strength was evaluated by the surface fracture state of the specimen and the amount of specimen adhered to the cellophane tape.

Brief description of the figures

Figure 1 is an enlarged cross section showing the felt molded product of the present invention. Figure 2 is an enlarged cross section showing a fiber mat before molding.

1 Felt molded product
2 Hard surface layer
3 Soft elastic core layer
4 Fiber cotton
5 Resin binder
6 Fiber mat

Figure 1

Key: 1 Felt molded product

2 Hard surface layer
3 Soft elastic core layer

Figure 2

Key: 4 Fiber cotton
5 Resin binder
6 Fiber mat

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㊵発明の名称　フエルト状成形物とその製造方法

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明　細　書

1．発明の名称

フェルト状成形物とその製造方法

2．特許請求の範囲

1. 繊維綿(4)と樹脂バインダー(5)からなるフェルト状成形物(1)であって、硬質表面層(2)と軟質弾性芯層(3)とが連続的に一体形成されてなることを特徴とするフェルト状成形物。

2 フェルト状成形物(1)は60～90重量％の繊維綿(4)と40～10重量％の樹脂バインダー(5)からなり、該成形物の見掛け密度が0.06～0.3g／cm³、厚さが3～50mm、圧縮弾性率が50％以上であり、少なくとも厚さ0.5mm以内が硬質表面層(2)を形成し、該硬質表面層(2)は繊維綿(4)が樹脂バイダー(5)で強固に固定された表面強度の良好な高密度層を形成しており、該表面層の見掛け密度は0.08～0.4g／cm³であり、該表面層(2)と連続一体化した軟質弾性芯層(3)は繊維綿(4)が樹脂バインダー(5)で緩く固定された弾力性のある低密度層で特に少なくとも成形物全体の厚みの1／2以上の厚みを占め、見掛け密度が0.05～0.25g／cm³と低く、かつ前記硬質表面層(2)と軟質弾性芯層(3)との見掛け密度比が1.1～2.0である請求項1記載のフェルト状成形物。

3 60～90重量％の繊維綿(4)塊に40～10重量％の樹脂バインダー(5)を付与し、開繊、積層して繊維マット(6)とした後、樹脂バインダー(5)の融点ないし融点より110℃高い温度域で、しかも成形時の繊維マット(6)の形態変化に於て、圧縮率が60～96％で減圧時の圧縮回復率が50～5％となる温度、圧力及び時間の条件で加熱加圧成形し、直ちに減圧して繊維マット(6)の圧縮回復率が50～5％の形態の状態で樹脂バインダー(5)の融点以下の温度にまで冷却し固定化することを特徴とするフェルト状成形物の製造方法。

3．発明の詳細な説明

〈産業上の利用分野〉

本発明は繊維綿と樹脂バインダーからなり、その最表面部は立毛繊維の少ない平滑面で、表面部は繊維綿が樹脂バインダーで強固に固定された表

面強度の良好な高密度層であり、この表面部と一体化した内部は繊維綿が樹脂バインダーで緩く固定された弾力性ある低密度層である表面強度及びクッション性の良好なフェルト状成形物とその製造方法である。このフェルト状成形物は上記の特徴により使用耐久性及びクッション性が良く、ベッド用、座布団用、カーペット用、畳用、包装用及びその他の用途のクッション材として最適である。

〈従来の技術〉

本発明のフェルト状成形物は従来の厚手不織布の部類に属し、特に樹脂バインダー使用乾式不織布に該当する。従来、不織布には上記の不織布の他に樹脂バインダー使用湿式不織布、ニードルパンチング不織布、水流絡合不織布及びメルトブローン不織布などがあり、それぞれ製造方法が異なり、その製品もそれぞれ特徴を有する。しかし、これら従来の不織布製造法では表面部だけ強力に樹脂固着すること、ニードルパンチングすること、或いは水流絡合することは難しく、仮りにできてもこれら処理だけでは表面部の固定が不十分であるため、本発明のごとき最表面が立毛繊維の少ない平滑面で表面部に表面強度の良好な高密度層と、その内部に弾力性ある低密度層を有する一体構造の不織布は造られていない。

したがって、従来の厚手の不織布をベッド用などのクッション材として使用する場合は、比較的柔らかくて弾力性のある厚手の不織布の表面に布や組織のしっかりした薄手の不織布を貼って、表面強度の補強をして使用している。

〈発明が解決しようとする課題〉

しかし、従来のこのような方法ではこれら表面補強材と厚手の不織布に一体性がないために、使用耐久性が劣る、クッション性が良くないなどの欠点が生じ、更にコスト高になる、生産性が悪いなどの欠点も出ている。本発明は、このような問題点を一挙に解決した全く新しい構造のフェルト状成形物とその製造方法を提供するものである。

〈課題を解決するための手段〉

本発明は繊維綿(4)と樹脂バインダー(5)からなるフェルト状成形物(1)であって、硬質表面層(2)と軟質弾性芯層(3)とが 連続的に一体形成されてなることを特徴とするフェルト状成形物である。

更には、フェルト状成形物(1)は 60～90重量%の繊維綿と40～10重量%の樹脂バインダーからなり、 この成形物の見掛密度が0.06～0.3g／cm³、厚さが3～50mm、 圧縮弾性率が50%以上であり、少なくとも厚さ0.5mm以内が硬質表面層(2)を形成し、その表面層(2)は 繊維綿が樹脂バインダーで強固に固定された表面強度の良好な高密度層を形成しており、 かつその見掛け密度は0.08～0.4g／cm³であり、 この表面層(2)と連続一体化した軟質弾性芯層(3)は 繊維綿が樹脂バインダーで緩く固定された弾力性のある低密度層で、特に、少なくとも成形物全体の厚みの 1/2以上の厚みを占め、見掛け密度が0.05～0.25g／cm³と低く、かつ前記表面層(2)と軟質弾性芯層(3)との見掛け密度比が1.1～2.0であることを特徴とする。

本発明のフェルト状成形物の好適な製造方法は次のとおりである。すなわち、60～90重量%の繊維綿塊に40～10重量%の樹脂バインダーを付与し、開繊、積層して繊維マット(6)とした後、 このバインダーの融点ないし 融点より110℃高い温度域で、 しかも成形時の繊維マット(6)の形態変化に於て、圧縮率が97～50%で減圧時の圧縮回復率が5～60%となる温度、 圧力及び時間の条件で加熱加圧成形し、 直ちに減圧して繊維マット(6)の圧縮回復率が 5～60%の形態の状態で樹脂バインダーの融点以下の温度にまで冷却し固定することを特徴とする。

本発明を更に詳しく説明するに当たり、物性値の測定方法について述べると、フェルト状成形物及びその一部分の厚さ測定はJIS－L－1096に準じたダイヤルゲージ式厚さ測定器(圧荷重50g／cm²)を使用し、最初の繊維マットの厚さ及び成形時の圧縮率算出の為の圧縮間隙の測定はスチール物差し、ノギス或いは隙みゲージを使用した。なおフェルト状成形物の表面部及び内部の見掛け密度の測定試料はこの製品の断面各部分を割漉機で分解して作成した。また用語の定義では圧縮率＝(繊

維マット厚さ－圧縮間隙)÷繊維マット厚さ×100、圧縮回復率＝フェルト状成形物の厚さ÷繊維マット厚さ×100とした。更にフェルト状成形物の圧縮弾性率及び破裂強さの測定はJIS－L－1096に準じ、引張強さ及び引裂強さの測定はJIS－L－1085に準じた。

本発明を図面を参照しながら、更に詳しく説明すると、次のようである。本発明の表面強度及びクッション性の良好なフェルト状成形物(1)は60～90重量％の繊維綿(4)と40～10重量％の樹脂バインダー(5)からなる。繊維綿(4)の量が60重量％以下即ち樹脂バインダー量が40％以上だとフェルト状成形物は硬くなりクッション性が悪くなる。また繊維綿の量が90重量％以上即ち樹脂バインダー量が10重量％以下であると表面部の表面強度は勿論のこと内部の強度も低下して実用性が無くなる。なお樹脂バインダーの一部或いは全部を熱融着性の繊維綿で置き換えることもできる。次に本発明のフェルト状成形物(1)の全体の厚さは3～50㎜である。3㎜以下では薄過ぎて表面部と内部との見掛け密度差を出し難くクッション性も良くない。また、50㎜以上では厚過ぎて成形時中央部に熱が伝わり難く樹脂バインダー(5)による繊維綿の固定が悪くて強度不良となる。また、全体の見掛け密度は0.06～0.3g／㎤である。0.06g／㎤以下だと全体強度、表面強度及びクッション性が不足し、0.3g／㎤以上だと硬過ぎてクッション性が悪くなる。

次に本発明の最大の特徴は、最表面は繊維綿が半ば皮膜化した樹脂バインダーで強固に固定された立毛繊維の少ない平滑面で、更に少なくとも厚さ0.5㎜以内の表面部は繊維綿が樹脂バインダーで強固に固定された高密度層を形成していることである。半ば皮膜化した平滑面及び高密度層は優れた表面強度を生みだす。表面部のこの高密度層は厚さが0.5㎜以上で、多くの場合1～2㎜に及ぶ。硬質表面層(2)の見掛け密度は0.08～0.4g／㎤である。見掛け密度が0.08g／㎤以下では柔らか過ぎて表面強度が悪く、また0.4g／㎤以上では表面が硬過ぎてクッション性が低下する。

更に本発明の第2の特徴は、この硬質表面層(2)と一体構造の軟質弾性芯層(3)は繊維綿が樹脂バインダーで緩く固定された弾力性のある低密度層であり、特に少なくとも全体の厚みの1/2以上の厚みを占める中央部は見掛け密度が0.05～0.25g／㎤と表面部に較べて顕著に低いことである。見掛け密度が0.05g／㎤以下では内部の繊維組織の固定が十分でなく崩壊しやすいし、柔らか過ぎて逆にクッション性が低下する。また、0.25g／㎤以上では軟質弾性芯層(3)が硬過ぎてクッション性が低下する。

更に本発明の第3の特徴は硬質表面層(2)と軟質弾性芯層(3)、特に後者の中央部との密度バランスであり、見掛け密度比1.1～2.0が適している。この見掛け密度比が1.1以下だと両層の密度差が小さ過ぎ、全体として硬過ぎてクッション性が悪いか、逆に柔らか過ぎて表面強度が不足し使用耐久性が低下する。また見掛け密度比が2.0以上であると両層の密度差が大き過ぎ、硬質表面層(2)のみが硬くなり過ぎクッション性が低下するか、あるいは軟質弾性芯層(3)が柔らか過ぎて形態が崩壊しやすい。上記のごとく最適見掛け密度範囲にあるフェルト状成形物(1)は圧縮弾性率が50％以上になり、クッション材として最適のクッション性を持つことになる。なお全層の構成は高密度の硬質表面層(2)の直ぐ下に低密度の軟質弾性芯層(3)がありその境界が明瞭な場合が多いが、高密度の硬質表面層(2)と低密度の軟質弾性芯層(3)との間で徐々に密度が低下して境界の明瞭でない場合もある。

本発明で用いる繊維綿(4)はポリエステル繊維、ナイロン繊維、アクリル繊維、ポリオレフィン繊維、ビニロン繊維などの合成繊維、レーヨン繊維、アセテート繊維などの化学繊維、木綿、羊毛、絹、麻などの天然繊維のいずれでもよく、また混合使用でもよい。なお本発明で用いるこれらの繊維綿(4)は正規の原料を用いたものの他に、紡績工程、不織布製造工程、染織工程、縫製工程などで発生する屑綿、屑糸、屑布、或いは使用済みの衣料などを開繊した回収屑綿でもよい。綿は開繊機を用

いて開繊し、更にラッパーやウエーバーなどの機械を用いて開繊、積層し繊維マット(6)とする。

本発明で用いる樹脂バインダー(5)の樹脂は、通常使用されている市販の熱硬化性樹脂あるいは熱可塑性樹脂が使用できる。熱硬化性樹脂としては、例えばフェノール樹脂があり、熱可塑性樹脂としては、例えばポリエチレン樹脂、ポリプロピレン樹脂、ポリエステル樹脂、ナイロン樹脂、ポリウレタン樹脂、ポリ塩化ビニル樹脂、エポキシ樹脂、ポリスチレン樹脂、SBR、NBRなどがある。使用する樹脂バインダーの形状は粉状、直径3～10㎜の小塊状、繊維状、ネット状、及び溶媒に溶解又は分散させた液状等の形態で用いる。使用方法としては樹脂バインダー(5)の形状によって使い分け、前記開繊から繊維マット製造までの任意の工程中に、繊維綿(4)に粉体を散布する方法、液体をスプレーする方法、塗布する方法、浸漬する方法あるいは繊維マット(6)中に混入する方法などがある。また融点の異なる複数の繊維綿を用いる場合は低融点側の繊維綿を樹脂バインダーとして或いはその一部として利用することができる。樹脂バインダー(5)の選定に当たって重要なことは、主体となる繊維綿(4)の融点よりも低融点の樹脂を選ぶことである。

なお、本発明の目的の一部は表面部の密度が内部に比べて高いフェルト状成形物を提供することにあるが、その為には使用する繊維マットの表面部の樹脂バインダー濃度を内部に比べて予め増やしておくことも有効である。その方法の一例は、表面部と内部の樹脂バインダー濃度が同じの繊維マットを造り、この繊維マットの表面に樹脂バインダー粉或いは液を乗せる方法がある。更にこの繊維マットには、着色剤、酸化防止剤、吸湿剤、消臭剤、増量剤等を予め添加しておくこともできる。

次に本発明において好適な加熱加圧成形条件について述べる。成形はプレス機を用いて行なう。プレス機は不連続の平盤プレス機でも、連続式のロール式プレス機或いはベルト式プレス機であってもよい。これらプレス機によるプレス工程の後には表面を平滑にし、かつその形態を好ましい圧縮回復率(好ましい厚さ)で冷却固定化する冷却用の金属板式、スチールベルト式、或いはロール式プレス設備が必要である。加熱加圧成形は樹脂バインダーが溶融し繊維綿は溶融し難い、しかも繊維マット最表面部にかかる温度圧力効果が中央部にかかる温度圧力効果よりも強くなる加熱加圧条件を選ぶ。その為には、加熱設備は熱プレス機からの熱伝導で繊維マット表面から徐々に内部に伝熱する方式、赤外線ヒーター、遠赤外線ヒーターからの輻射熱でプレス機や繊維マット表面を加熱して繊維マット表面から徐々に内部に伝熱する方式が有効である。なお熱風加熱等対流で表面と内部をほぼ均一に加熱する方式は好ましくない。但し熱風等で繊維マットを予備加熱して最終的には上記熱プレス機で加熱する併用方式は有効である。具体的には60～90重量％の繊維綿塊に40～10重量％の樹脂バインダーの融点ないし融点より110℃高い温度範囲で、しかも成形時の繊維マット(6)の形態変化に於て、圧縮率が60～96％で減圧時の圧縮回復率が50～5％となる温度と圧力及び時間の条件で前記プレス機を用いて加熱加圧成形し、直ちに減圧して、前記冷却用のプレス設備で繊維マットの圧縮回復率を50～5％の形態に保ち、加圧或いは表面摩擦しながら樹脂バインダーの融点以下の温度にまで冷却し固定する。成形温度が融点以下ではしっかりと固定された成形物ができないし、融点より110℃以上高い温度では焦げて悪臭を放つ。また、圧縮率が96％以上で圧縮回復率が5％以下になると全体が硬くなり過ぎてクッション性が無くなり、圧縮率が60％以下で圧縮回復率が50％以上になると柔らか過ぎて表面強度が不足し使用耐久性が低下する。なお上記の最適条件を満足する因子は繊維マットの厚さ、見掛け密度、成形の温度、圧縮率(成形時の温度、圧力、厚み設定、時間等が関与)、及び成形後の圧縮回復率(成形時の圧縮率、冷却時のプレス設備の厚み設定等が関与)であり、これら因子の条件の総合したものが結果として成形製品の良否に現れる。成形時の圧力と時間以外の最適条件は上記の如くで

ある。圧力と時間の条件は温度の影響をも考慮して上記の最適圧縮率及び最適圧縮回復率になる圧力と時間を選ぶ。圧力は0.1〜100kg／cm²、時間は1〜300秒の条件から選び得る。更に最適の圧縮率、圧縮回復率を得るための有利な方法としては、加熱加圧成形時、及び冷却固定化時に上下のプレス盤、ロールあるいはベルトの間に所定の間隙を保つための厚み設定装置やスペーサーを設ける方法がある。これら装置の使用により、成形の温度、圧力、時間の条件が最適条件より若干ずれても、最適の圧縮率及び圧縮回復率を得ることができる。なお加熱成形時採用の間隙設定値と冷却固定化時採用の間隙設定値は厚さが異なってもよい。

加熱加圧成形処理は上記の如く一段で実施する方法の他に、弱い加熱加圧条件で予備成形を行なって後、上記の如き本成形を行なういわゆる二段成形法も実施できる。この場合、第一段目の圧縮率(即ち厚さ)は第二段目の圧縮回復率以上にとどめて、第二段目では第1段成形前の厚さに対して前記の最適圧縮率及び圧縮回復率になるような条件を採用する。二段成形法の利点は、第一段目で比較的形態の安定した繊維マットを得るので、第二段目の本成形での取り扱いが容易であること、及び平板状以外の形状の成形物も容易に造れる利点もある。

〈作用及び発明の効果〉

本発明のフェルト状成形物(1)は本発明の原料、原料組成と加熱加圧成形条件によってのみ造り得る。即ち繊維綿(4)に樹脂バインダー(5)を付与し、開繊、積層して造った繊維マット(6)を、この樹脂バインダー(5)が溶融し繊維綿(4)に溶融し難い、しかも繊維マットの最表面部にかかる温度圧力効果が中央部にかかる温度圧力効果よりも強くなる加熱加圧条件で成形して後、緻密な平滑面を得るための圧着或いは摩擦冷却固定化処理を行なうことにより、最表面部には繊維綿(4)が樹脂バインダー(5)で強固に固定された立毛繊維の少ない平滑面で表面部は繊維が樹脂バインダーで強固に固定された表面強度の良好な高密度層であり、その内部には繊維綿(4)が樹脂バインダー(5)で緩く固定され硬質表面層(2)の見掛け密度よりも低い密度で弾力性のある低密度層であり、従来品には見られなかった組成と構造の使用耐久性及びクッション性の良好なフェルト状成形物を得る。

〈実施例〉

以下に本発明の実施態様を具体例で説明するが、本発明はこれらの実施例に限定されるものではない。

実施例1

縫製工程で発生したポリエステル綿混の布屑を開繊機に掛けて屑綿を製造した。得られた屑綿に融点135℃のポリエチレン樹脂粉末を繊維／樹脂の重量比率が4／1となる量でほぼ均一に混入させた後、簡単なカードにかけて繊維マット(6)を造った。この繊維マット(6)は厚みが60mmで、見掛け密度が0.028g／cm³で、ふわふわした状態のものであった。

次に上記繊維マット(6)に下記の方法で平板型の加熱加圧成形を行なった。先ず、この繊維マット(6)を2枚のクロムメッキした鉄製平板型の間に置いた。なお、この2枚の平板型の間の4隅には、成形時繊維マット(6)の厚みを一定に保ち、また、最表面部と内部とに加熱加圧効果の差を持たせる為に、厚さ13mmの鉄板小片をスペーサーとして置いた。そのスペーサーの設置により成形時の適正温度圧力範囲が広くなり、更には繊維マット(6)の最表面部は加熱加圧効果を受け易く、内部、特に中央部は加熱加圧効果を受け難くなり好都合となる。次に、予め210℃に昇温した油圧式平盤熱プレス機の定盤の上に上記の繊維マット(6)を挟んだ鉄製平板型を載せて加圧力30kg／cm²で60秒間プレスし(圧縮率78%)、次にこの繊維マット及びスペーサーを挟んだ鉄板型を直ちに別の水冷式冷却プレス機へ移して、加圧力5kg／cm²で120秒間冷却プレスした後、取り出した。

得られた平板状のフェルト状成形物(1)は全体の厚さが15mmで(圧縮回復率25%)、見掛け密度が0.11g／cm³で、最表面は繊維綿が半ば皮膜化した樹脂バインダーで強固に固定された立毛繊維の少ない平滑面で、厚さ約1mmの表面部には繊維綿が

樹脂バインダーで強固に固定された表面強度の良好な高密度層が形成されており、この部分の見掛け密度は0.15g／cm³であり、内部には繊維綿(4)が樹脂バインダー(5)で緩く固定された弾力性のある低密度層が形成されており、特に中央部(厚さ8mm)の見掛け密度は0.08g／cm³であった。

このフェルト状成形物(1)は第1表に示す如く従来品に比べて優れた諸物性値を有する。なお、表面強度は特殊な方法のセロテープ剥離試験によった。試験方法は第1表の脚注に示した。

そのフェルト状成形物(1)は上記の諸性質により使用耐久性及びクッション性が良好でベッド用、座布団用クッション材として最適である。

比較例1

実施例1と同じ繊維マットを使用し、鉄線で造った上下一対の網目状コンベアベルトの間にこの繊維マットを挟んで、予め190℃に加熱した熱風処理室内を240秒間通過させた。その室内通過時には上下コンベアベルトの間隙が13mmになるように厚み設定装置の設定をし、多数対の非加熱プレスロールでこのコンベアベルトを押さえる方式で繊維マットの加熱加圧処理をした。この際の圧縮率は78%であった。室内通過後空気冷却方式でその繊維マットを冷却し、コンベアベルトから取り出し、厚さ18mm(圧縮回復率30%)見掛け密度0.094g／cm³のフェルト状成形物を得た。このフェルト状成形物は成形時に熱風が繊維マット表面だけでなく内部にまでほぼ均一に通過した為に、更には面状でなく網目状の加圧を行なった為に、表面部と内部との見掛け密度の差を造り得ずクッション性が劣り、また樹脂バインダーによる最表面及び表面部の繊維固定も不十分で、最表面には無数の繊維が乱立し最表面及び表面部の表面強度も悪い。そのフェルト状成形物の諸物性値を第1表に示す。

このフェルト状成形物はベット用クッション材として用いるには、表面強度が不十分である為、表面に布又は組織のしっかりした薄手の不織布を貼って表面強度の補強をして使用している。

比較例2

実施例1と同じ繊維マットを使用し、実施例1で用いたと同じ熱プレス機及び2枚のクロムメッキを施した鉄製平板型を使用して加熱成形処理をした。但し、スペーサーは使用しなかった。すなわち、予め210℃に昇温した油圧式平盤熱プレス機の定盤の上に繊維マットを挟んだ鉄製平板型を乗せて加圧力50kg／cm²で60秒間熱プレスし(圧縮率96.7%)、次に、この繊維マットを挟んだ鉄板型を直ちに別の水冷式冷却プレス機へ移して加圧力5kg／cm²で120秒間冷却プレスして取り出した。得られた平板形のフェルト状成形物は全体の厚さが2.5mm(圧縮回復率4.2%)と薄く、見掛け密度が0.68g／cm³と高密度で表面部と内部との密度差もなく、ベニヤ板状の硬いものであり、クッション材には適さない。

実施例2

比較例1で造ったフェルト状成形物(厚さ18mm、見掛け密度0.94g／cm³)を使用し、これを実施例1と同じ熱プレス機、2枚のクロムメッキ処理鉄製平板型及び厚さ13mmの鉄板小片スペーサーを使用して、実施例1と同じ加熱加圧成形条件(温度210℃、加圧力30kg／cm²、時間40秒間)と、実施例1と同じ冷却プレス条件(加圧力5kg／cm²、時間120秒間)で処理した。このようにして得られたフェルト状成形物は厚さが14mm、全体の見掛け密度が0.12g／cm³で、立毛繊維の少ない緻密な最表面を有する表面層(厚さ1mm)は見掛け密度が0.17g／cm³と高く、その内部の弾力性ある低密度層は特に中央部(厚さ8mm)の見掛け密度が0.09g／cm³と低く、実施例1とほぼ同等の外観、断面構造及び物性値を有した。この物性値を第1表に示す。

このものは、上記のように実施例1と同等の諸物性により使用耐久性及びクッション性が良好でベット用、座布団用及びその他のクッション材として最適である。

以下余白

第 1 表

項目＼試料		実施例 1	実施例 2	比較例 1
厚さ	mm	15	14	18
見掛け密度	g／cm³	0.11	0.12	0.094
		0.15	0.17	
		0.08	0.09	
引張強さ	g／cm²	3.65	3.87	1.24
引裂強さ	kg	5.03	5.52	1.68
圧縮弾性率	%	82.8	84.3	48.6
破裂強さ	kg	90	98	15.3
表面強度 * (セロテープ剥離試験)		剥離なし	剥離なし	剥離激しい

* 測定方法：試験片(50×150mm)の長手方向にセロテープ(25×120mm)を100m長はり棒で上からこすって接着を強めた後20mmの端を手で持って90°方向へ一気に剥がし、試験片表面破壊状態及びセロテープに付着した試験片部分の量の多少で評価した。

4．図面の簡単な説明

第1図は本発明のフェルト状成形物の断面拡大図、第2図は成形前繊維マットの断面拡大図である。

(1) フェルト状成形物　(2) 硬質表面層

(3) 軟質弾性芯層　(4) 繊維綿

(5) 樹脂バインダー　(6) 繊維マット

以上

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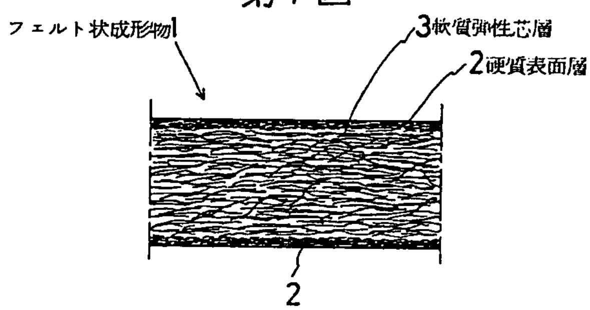
第1図



第2図